

*SOME EFFECTS OF NONCONTINGENT POSITIVE REINFORCEMENT
ON MULTIPLY CONTROLLED PROBLEM BEHAVIOR AND
COMPLIANCE IN A DEMAND CONTEXT*

EINAR T. INGVARSSON

YOUNGSTOWN STATE UNIVERSITY

SUNGWOO KAHNG

KENNEDY KRIEGER INSTITUTE AND
JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE

AND

NICOLE L. HAUSMAN

KENNEDY KRIEGER INSTITUTE

Functional analysis suggested that the problem behavior of an 8-year-old girl with autism was maintained by escape from demands and access to edible items. Noncontingent delivery of an edible item was sufficient to increase compliance and reduce the rate of problem behavior without the use of escape extinction in a demand context. Leaner and richer schedules of noncontingent reinforcement were equally effective, and there were minimal differences between noncontingent reinforcement and differential reinforcement of compliance.

DESCRIPTORS: autism, escape behavior, noncontingent reinforcement, problem behavior, reinforcement density

Escape-maintained problem behavior is relatively common among individuals with developmental disabilities (Iwata et al., 1994). Escape extinction, although typically effective, may lead to undesirable side effects such as temporary increases in the rate or intensity of problem behavior (Goh & Iwata, 1994) and may be impractical with some individuals (e.g., those who are physically large and aggressive; Piazza, Moes, & Fisher, 1996). Given these potential limitations, researchers have evaluated the use of reinforcement of alternative behavior (DRA) without escape extinction (e.g., Lalli et al., 1999). Although generally effective in

reducing problem behavior, DRA may limit the individual's contact with reinforcement if appropriate behavior (e.g., compliance) occurs at low rates. One method of increasing contact with reinforcers may be through the use of noncontingent reinforcement (NCR). In a recent study, Wilder, Normand, and Atwell (2005) found that noncontingent positive reinforcement (i.e., continuous access to a preferred movie) reduced escape-motivated self-injury and increased food acceptance in a young girl with autism. The purpose of the current study was to replicate and extend the findings of Wilder et al. by (a) evaluating NCR in the treatment of behavior sensitive to both escape and edible items as reinforcers, (b) examining whether NCR would lead to results comparable to DRA, and (c) evaluating whether the effectiveness of NCR might be related to the density of reinforcer delivery (i.e., high- vs. low-density NCR schedules).

We thank Nicole Rodriguez, Ellen Farrell, and Camille Mongeon for their assistance with this study.

Address correspondence to Einar T. Ingvarsson, Department of Psychology, DeBartolo Hall, Youngstown State University, One University Plaza, Youngstown, Ohio 44555 (e-mail: etingvarsson@ysu.edu).

doi: 10.1901/jaba.2008.41-435

METHOD

Participant, Setting, and Tasks

Manuela was an 8-year-old girl who had been admitted to an inpatient unit for the assessment and treatment of severe problem behavior. She had been diagnosed with autism, mild cerebral palsy, moderate mental retardation, and obsessive-compulsive disorder. Manuela's communication skills were limited, but she occasionally communicated using single words and short phrases. All sessions were 10 min in length and were conducted in a bedroom on the inpatient unit. During sessions, Manuela and the therapist sat on a mat on the floor, and one or two observers sat in chairs 2 m away. In demand sessions, the therapist presented developmentally appropriate tasks that included writing and tracing letters and numbers, drawing and tracing shapes, buttoning clothes, tying shoelaces, stringing beads, and putting puzzles together.

Measurement

Manuela's problem behavior consisted of aggression, disruptions, and self-injurious behavior (SIB), which were measured using event recording and are reported as responses per minute. *Aggression* was defined as hitting, scratching, pinching, biting, throwing objects at others, kicking, and pushing. *Disruptions* were defined as banging on objects, swiping objects off surfaces, and throwing, breaking, or otherwise damaging or destroying objects. *SIB* was defined as hitting or attempting to hit her head on hard surfaces, hitting herself with her hand or an object, and self-biting. We also collected data on *compliance*, which was defined as task completions following vocal instructions and model prompts. These data are expressed as percentage of compliance per session. Observers also scored the rate of therapist vocal instructions and delivery of the edible reinforcer.

Procedure and Experimental Design

Functional analysis. We conducted a functional analysis using methods similar to those

described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). Demand, attention, toy play, ignore, and tangible conditions were alternated in a multielement design. In the tangible condition, the therapist delivered Manuela's most highly preferred food item (as identified via a preference assessment using the procedures described by Fisher *et al.*, 1992) contingent on problem behavior. This condition was included based on anecdotal observations and parent reports that Manuela often engaged in problem behavior when denied access to edible and other favored items.

Treatment evaluation. Baseline consisted of two conditions, demand and toy play (conducted in a manner identical to the functional analysis), that were alternated in a multielement design. We chose these conditions because anecdotal observations indicated that Manuela's problem behavior was often evoked by demands. In the demand condition, the therapist presented continuous demands and implemented least-to-most prompting (vocal instructions, model prompts, and physical guidance) as necessary to aid in completion of the task. A 30-s break from demands was provided immediately following problem behavior. The therapist signaled the start of the break by saying, "Okay, you don't have to" and removed the task materials. In the toy play condition, preferred toys were continuously available, no demands were presented, no social consequence followed problem behavior, and the therapist provided attention every 30 s. The therapist delivered praise for compliance and responded to appropriate communication if any occurred.

NCR was identical to the demand condition, except that the therapist delivered preferred edible items (cheese crackers or graham crackers) immediately before the initial vocal instructions, independent of responding. To reduce the likelihood of accidental reinforcement of compliance, the therapists made sure that at least 10 s elapsed between the end of one trial and the beginning of the next. Before each

session, Manuela was allowed to choose which edible item would be used. We evaluated two NCR schedules: low density (LD; an edible item was delivered prior to every fourth demand) and high density (HD; an edible item was delivered before every demand). We first compared these conditions in a multielement design and then in consecutive phases following a return to baseline. To increase the likelihood of discrimination between conditions, we assigned a specific therapist to each condition following baseline (the therapists conducted sessions in an alternating fashion during baseline). The DRA condition was similar to the demand condition, except that the therapist delivered preferred edible items contingent on compliance. This condition was compared to the HD condition in a multielement design.

Interobserver Agreement

A second observer collected data simultaneously but independently during 38% of sessions. Interobserver agreement scores were calculated by determining proportional agreement within 10-s intervals and calculating a mean for the intervals for each session. Mean agreement was 99% (range, 90% to 100%) for problem behavior, 97% (range, 92% to 100%) for compliance, and 95% (range, 90% to 100%) for edible-item delivery.

RESULTS AND DISCUSSION

In the functional analysis (Figure 1, top panel), consistently elevated rates of problem behavior were observed only in the tangible condition. In the baseline condition of the treatment evaluation, problem behavior was elevated in the demand condition but remained at zero in the toy play condition (Figure 1, second panel), suggesting the sensitivity of problem behavior to both edible items and escape from demands. Compliance was low in baseline (Figure 1, third panel). With the onset of NCR, problem behavior decreased and compliance increased to approximately 80% in

both density conditions. A second baseline phase (demand condition only) resulted in higher rates of problem behavior and lower compliance. In the subsequent NCR phases, problem behavior and compliance were similar to the previous NCR phase, although slightly higher rates of problem behavior occurred in the LD condition. Finally, there were minimal differences between HD NCR and DRA (Figure 1, second and third panels). These results suggest that the noncontingent delivery of preferred food may be valuable in reducing problem behavior in demand contexts without the use of escape extinction. Because NCR entails frequent contact with the reinforcer independent of compliance, this approach may be particularly valuable when initial compliance is low.

We conducted a contingency analysis, using procedures similar to those described by Vollmer, Borrero, Wright, Van Camp, and Lalli (2001), to evaluate whether high compliance and low rates of problem behavior during NCR may have occurred due to adventitious edible reinforcement of compliance. We examined time-stamped data for evidence of a positive contingency between compliance and edible items (data are available from the first author). The mean contingency value for all NCR sessions was -0.07 ($SD = 0.16$), where zero indicates lack of a contingency, 1.0 indicates a perfect positive contingency, and -1.0 indicates a perfect negative contingency. Thus, the available data indicated that adventitious reinforcement of compliance did not account for the present findings.

The current results extend those of Wilder et al. (2005), who showed decreases in escape-maintained problem behavior and increases in compliance (i.e., food acceptance) as a function of continuous access to a preferred movie in the absence of escape extinction. Wilder et al. demonstrated an escape function but did not evaluate whether access to the movie functioned to maintain SIB. The current study, however,

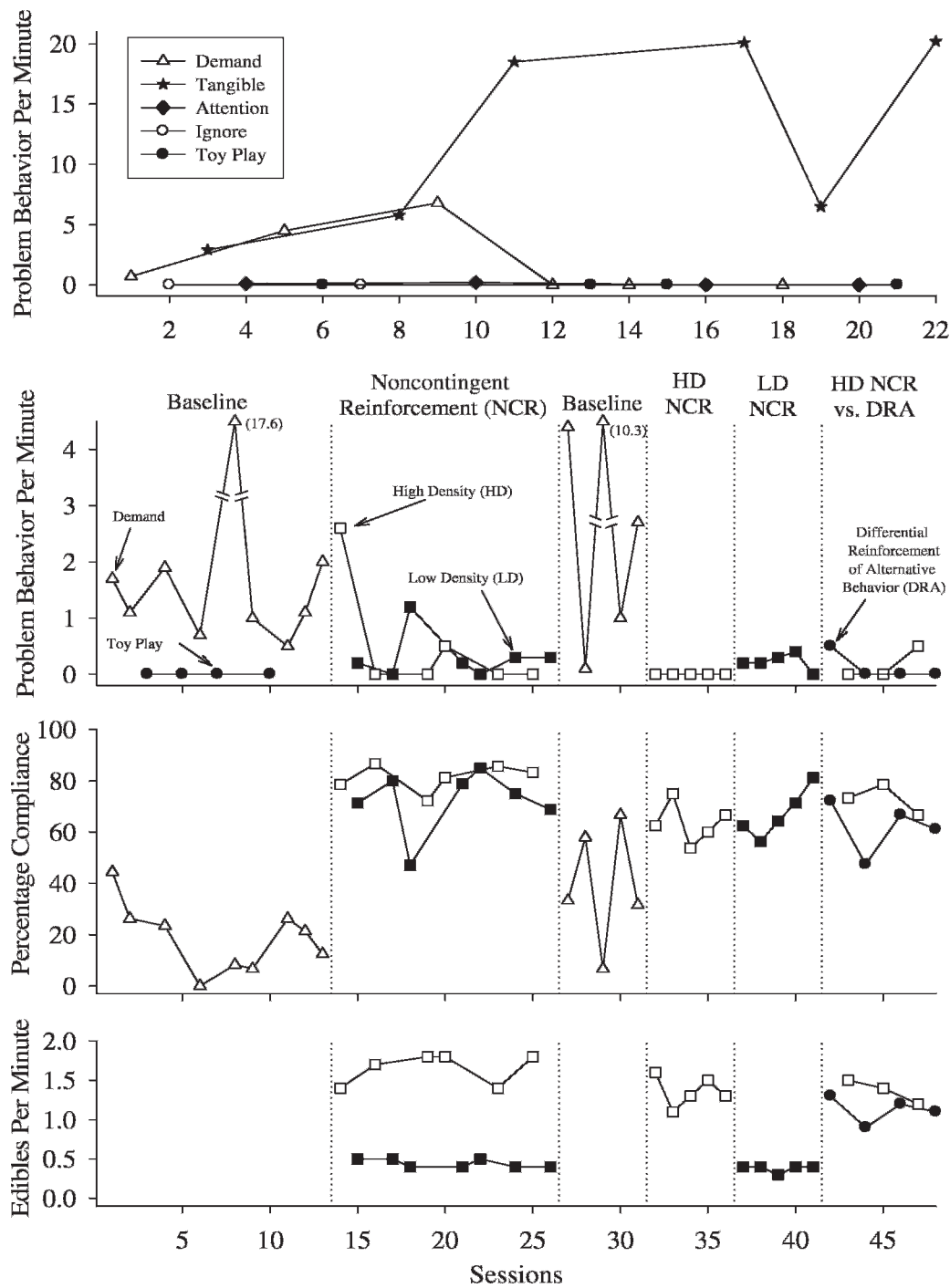


Figure 1. Results of the functional analysis are presented in the top panel. The second panel shows the rate of problem behavior, the third panel shows the percentage of compliance, and the bottom panel shows edible delivery per minute during the treatment evaluation.

showed problem behavior to be maintained by both escape and access to edible items; the reinforcer used during NCR was thus shown to be functionally relevant with respect to the problem behavior. Future studies should evaluate whether functionally related tangible reinforcers are more likely than function-irrelevant reinforcers to reduce escape-maintained behavior when delivered noncontingently.

Interestingly, compliance was high in both NCR conditions despite the lack of a contingency between compliance and reinforcement. The delivery of the edible reinforcer may have served a discriminative function that set the occasion for compliance. Historically, compliance may have been maintained by tangible reinforcement, and edible delivery may have signaled the availability of more edible delivery, thereby setting the occasion for compliance. Alternatively, edible delivery may have reduced the aversiveness of demands via stimulus-stimulus pairings or by serving as an abolishing operation (i.e., the value of a break from demands as reinforcement may have been reduced because edible items were not delivered during breaks). It is also possible that when edible reinforcement was introduced, delivery of breaks following problem behavior came to serve as punishment for noncompliance, because delivery of the next edible item was delayed.

In the final phase, we briefly compared NCR to DRA. Both were effective in maintaining low rates of problem behavior and high levels of compliance. Given the relatively brief comparison, future studies should conduct a more thorough comparison of NCR and DRA. Although edible delivery was not yoked between the HD NCR and DRA conditions, similar density levels resulted (Figure 1, fourth panel). Nevertheless, future research should conduct such yoking to assure meaningful comparisons between DRA and NCR.

Several authors have suggested that a high overall density of positive reinforcement may

be a crucial component of successful behavioral interventions (e.g., Cautela, 1984). However, a consistent differential effect of NCR density was not found at the parameters evaluated in the current study, suggesting that even relatively lean schedules of NCR may be effective in producing low rates of problem behavior and higher levels of compliance (cf. Hagopian, Fisher, & Legacy, 1994). Although the current procedures successfully created differences in reinforcement density levels (Figure 1, fourth panel), the evaluation is limited because the density levels were determined arbitrarily. It is possible that a more prolonged evaluation or greater differences in density may have revealed differentiated outcomes. Future research should attempt to elucidate the optimal NCR densities under varying treatment conditions. Finally, it is possible that delivering edible items prior to demands may seem counterintuitive to some treatment implementers, leading to decreased probability of treatment acceptance. Future research should therefore evaluate the social acceptability of these procedures.

REFERENCES

- Cautela, J. R. (1984). General level of reinforcement. *Journal of Behavior Therapy and Experimental Psychiatry*, 15, 109–114.
- Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, 25, 491–498.
- Goh, H. L., & Iwata, B. A. (1994). Behavioral persistence and variability during extinction of self-injury maintained by escape. *Journal of Applied Behavior Analysis*, 27, 173–174.
- Hagopian, L. P., Fisher, W. W., & Legacy, S. M. (1994). Schedule effects of noncontingent reinforcement on attention-maintained destructive behavior in identical quadruplets. *Journal of Applied Behavior Analysis*, 27, 317–325.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, 27, 197–209. (Reprinted from *Analysis and Intervention in Developmental Disabilities*, 2, 3–20, 1982)

- Iwata, B. A., Pace, G. M., Dorsey, M. F., Zarcone, J. R., Vollmer, T. R., Smith, R. G., et al. (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. *Journal of Applied Behavior Analysis*, 27, 215–240.
- Lalli, J. S., Vollmer, T. R., Progar, P. R., Wright, C., Borrero, J., Daniel, D., et al. (1999). Competition between positive and negative reinforcement in the treatment of escape behavior. *Journal of Applied Behavior Analysis*, 32, 285–296.
- Piazza, C. C., Moes, D. R., & Fisher, W. W. (1996). Differential reinforcement of alternative behavior and demand fading in the treatment of escape-maintained destructive behavior. *Journal of Applied Behavior Analysis*, 29, 569–572.
- Vollmer, T. R., Borrero, J. C., Wright, C. S., Van Camp, C., & Lalli, J. S. (2001). Identifying possible contingencies during descriptive analyses of severe behavior disorders. *Journal of Applied Behavior Analysis*, 34, 269–287.
- Wilder, D. A., Normand, M., & Atwell, J. (2005). Noncontingent reinforcement as treatment for food refusal and associated self-injury. *Journal of Applied Behavior Analysis*, 38, 549–553.

Received February 2, 2007

Final acceptance February 22, 2007

Action Editor, James Carr